E.L.S. MN SPS-9

BRAUN[SM]
INTERTEC

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Engineers and Scientists Serving the Built and Natural Environments®

Memorandum

Date: June 9, 1995

To: See Distribution

From: Ann Johnson

Re: Minnesota SPS-9 Construction Report

Attached is a copy of the Minnesota SPS-9 Construction Report. Please route or distribute additional copies as you think appropriate. Let me know if you need more copies.

cc: MW Monte Symons, FHWA (1 copy)
Fred Mauer, MnDOT (4 copies)
Gene Skok, Braun Intertec (1 copy)
Dick Ingberg, LTPP (1 copy)

SPS-9 Construction Report
US-169 Near Belle Plaine, Minnesota
Sections 270901 to 270903

SHRP North Central Region

Report Prepared by:

Ann M. Johnson, P.E.
Braun Intertec Corporation
6875 Washington Ave S
P.O. Box 39108
Minneapolis, MN 55439-0108

April 1995

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The SPS-9 Experimental Design and Research Plan

The SPS-9 experiment is entitled "Validation of SHRP Asphalt Specifications nd Mix Design and Innovations in Asphalt Pavements." The SHRP asphalt research is focused on delivering two main products:

- Performance-based asphalt binder specification
- Performance-based asphalt-aggregate mixture specification including the mix design and analysis system

In addition, the SHRP Asphalt Research provides a forum for evaluating innovations in asphalt pavement, such as Stone Matrix Asphalt (SMA) and other materials.

The successful development and refinement of performance-based specifications for asphalt binder and asphalt-aggregate mixtures requires the validation of the binder and mixture properties as important determinants of in-place pavement performance. Also, the evaluation of innovative asphalt pavement materials requires in-service testing under actual traffic and climate conditions.

The SHRP asphalt research program is designed to develop performance-based specifications that address six pavement performance factors: permanent deformation, fatigue cracking, low-temperature cracking, moisture sensitivity, aging, and adhesion. With the results, it is hoped that the requirements for a new or reconstructed asphalt pavement may be defined in terms of the required levels of serviceability in each of these six areas for present and projected traffic loads and environmental conditions.

The SHRP asphalt research program was founded on the premise that asphalt concrete pavement performance is significantly influenced by the properties of the asphalt binder. To design a pavement that provides the performance dictated by its present and future environment, first consideration must be given to selecting an asphalt binder whose properties ensure the required performance levels.

After the influence of the asphalt binder on the performance is defined, the effect of its combination with aggregate must be considered. Some locally-available aggregates may actually detract from the performance-based response of the binder, necessitating a change in aggregate or binder. There is also the possibility that certain aggregates may enhance binder performance, allowing wider latitude in materials selection or pavement thickness.

The mixture specification is viewed as modulating the binder response in each performance area. The availability of both specifications allows a range of materials selection options to be considered for any particular paving project.

The performance-based specification limits and requirements are being developed from an extensive data base related to the types of pavement performance factors that can be defined quantitatively, as measured by accelerated, standardized tests using well-established performance prediction models and validated by correlation with in-place field pavement data.

The objectives of the SPS-9 study are as follows:

- To further validate the performance-based asphalt and asphalt-aggregate mixture specifications through controlled SPS projects;
- To provide for a direct comparison, in terms of measured performance and life-cycle costing analysis, between existing highway agencies' asphalt specifications, asphalt-aggregate mixture specifications, mix design procedures and SHRP's performance-based specifications and mix design and analysis system, stone matrix asphalt (SMA) mixtures, and other innovative features;
- To provide data collected over a long term from controlled field experiments and to provide for step-by-step procedures employing these data for modification of specification requirements at the local,regional or national level.

For the SPS-9 experiment, each test site includes the state's current mix design and the mix developed by SHRP's mixture design and analysis system. Other mixtures may be included along with these two sections. The Minnesota SPS-9 project included the Minnesota DOT standard mix, the SHRP SUPERPAVE mix, one SMA mixture, a section with the standard MnDOT aggregate and SHRP modified asphalt cement, and a section with the SUPERPAVE aggregate gradation and MnDOT standard unmodified asphalt cement. Figure 1 shows the Minnesota SPS-9 layout.

Project Details

The Minnesota SPS-9 project was constructed in 1993 and is located in the southbound driving lane of US-169, near Belle Plaine (see Figure 2 for project location). The project involved the overlay of a cracked and seated jointed plain concrete pavement. The SPS experiment consisted of five test sections, including one Minnesota DOT mixture section, one SUPERPAVE section, one SMA section, a section with the standard MnDOT aggregate and SHRP modified asphalt cement, and a section with the SUPERPAVE aggregate gradation and MnDOT standard unmodified asphalt cement. It is built in the dry-freeze zone. Subgrade soils on the project are clay loam.

The typical sections for the project are shown in Figure 3. The existing concrete pavement varied in depth from 7 inches on the edges to 9 inches at centerline. Prior to overlaying, the concrete was cracked and seated at an interval of 1.5 feet. All joints and severe transverse cracks were also patched. A minimum leveling course of 1-1/2 inches was placed over the existing concrete pavement, followed by 2-1/2 inches of bituminous binder course, and 1-1/2 inches of bituminous wearing course mixture. Material was placed and compacted according to standard MnDOT specifications section 2331.

US-169 carries an average two-way ADT of 21,378, with 9.3 percent trucks. The estimated design 18K ESAL rate in the SHRP lane is 391,000 with a total of 10,000,000 18K ESAL applications over the 20-year design period.

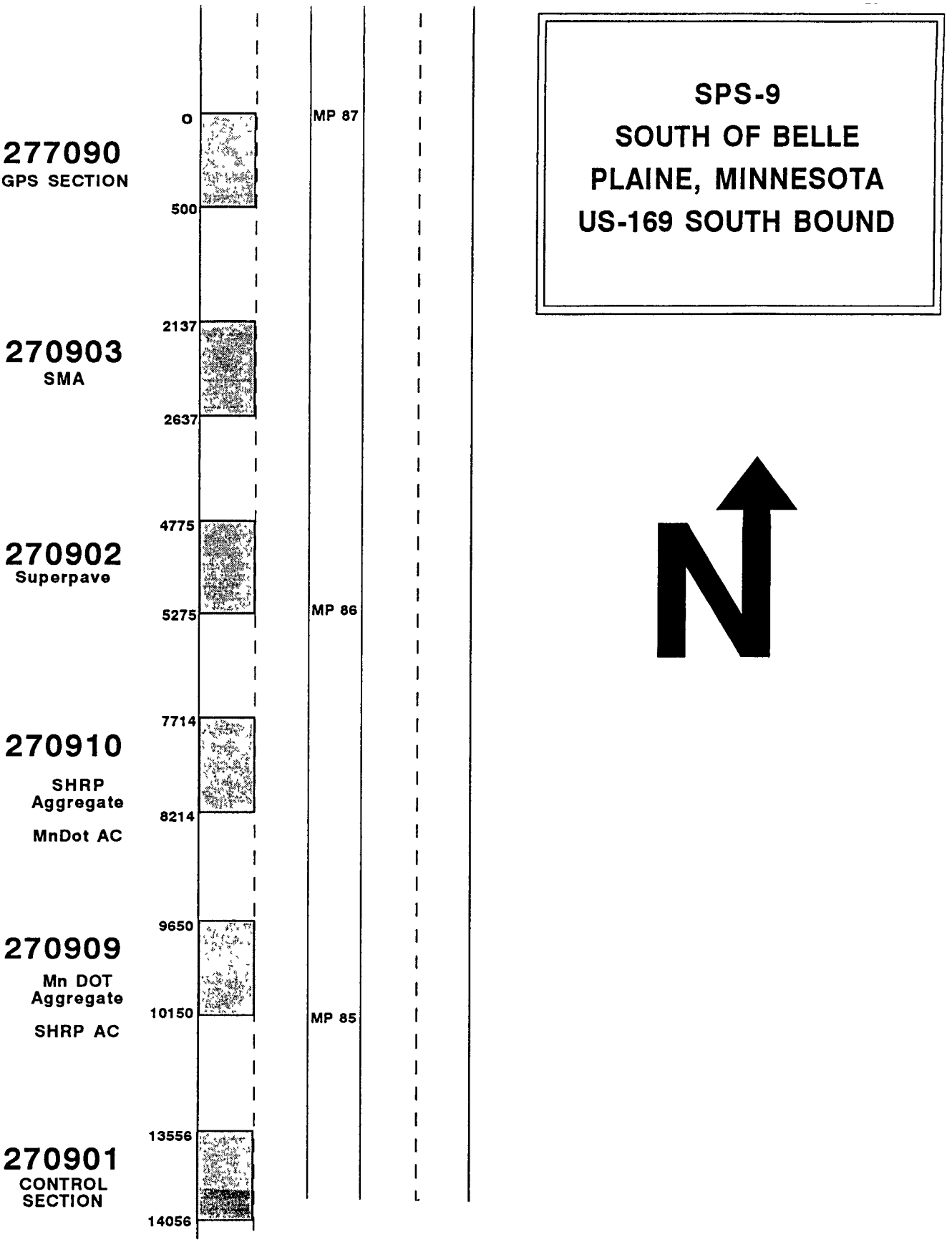


Figure 1. Project Layout

There were no known deviations from project guidelines. All test sections were located south of Belle Plaine. There are three horizontal curves located in the SHRP areas and the vertical grade in the sections varies from -2.40 to +1.6 percent in the direction of travel. Three sections are located on fill sections, three on cut sections, and two contain underground structures located more than five feet below the pavement elevation.

No weather station has been installed to date, but one is scheduled for installation in 1994. A bending plate weigh-in-motion system was installed at milepost 86+00.49, and was supplied from International Road Dynamics.

Project Coordination

The Minnesota DOT conducted the materials sampling and testing, and also provided their own Resident Engineer. Bill Bottemiller served as Project Engineer and Dick Hoppenrath served as Resident Engineer for the DOT. The following people were actively involved in the project:

Minnesota Department of Transportation:

Curt Eastland
Curt Turgeon
MnDOT Materials Research
1400 Gervais Ave
Maplewood, MN
(612) 779-5592

Mike Robinson
George Shorba
MnDOT Design
5801 Duluth Street
Golden Valley, MN 55422
(612) 591-4651

North Central Regional Coordination Office:

Gene Skok
Ann Johnson
Ron Urbach
Braun Intertec
6875 Washington Ave S
P.O. Box 39108
Minneapolis, MN 55439-0108
(612) 941-5600

Richard Ingberg
FHWA
6875 Washington Ave S
P.O. Box 39108
Minneapolis, MN 55439
(612) 942-3066

The general contractor for this project was:

Valley Paving, Inc.
8800 13th Ave East
Shakopee, MN 55344

Phone: (612) 445-8615

Rich Carron oversaw operations for the contractor during construction.

Layout

Figure 1 shows the section layout, and Table 1 gives a description of the sections.

Table 1. Minnesota SPS-9 Section Layout

Mile Post	SHRP ID	Bit. Level	Bit. Base		Bit. Surface	
			Type	Depth	Type	Depth
84+00.055 - 84+00.645	270901	MnDOT	MnDOT	2.5"	MnDOT	1.5"
85+00.000 - 85+00.095	270909	MnDOT	MnDOT	2.5"	MnDOT agg, SHRP oil	1.5"
85+00.367 - 85+00.462	270910	SHRP agg, MnDOT oil	SHRP agg, MnDOT oil	2.5"	SHRP agg, MnDOT oil	1.5"
86+00.000 - 86+00.095	270902	SHRP	SHRP	2.5"	SHRP	1.5"
86+00.500 - 86+00.595	270903	MnDOT	MnDOT	2.5"	SMA	1.5"

Note: All sections received variable depth bituminous level course prior to overlay.

Material Sampling and Testing

The Material Sampling and Testing Plan is shown in Figure 4. MnDOT personnel conducted all sampling and testing and data collection, with assistance from the LTPP North Central Regional Office. Table 2 gives a listing of all samples taken for the project.

Construction

Construction of the project began June 25, 1993, with the cracking and seating of the existing concrete pavement. The MnDOT standard leveling course was placed on sections 270901, 270903, and 270909 August 19, 1994. All lifts on the SHRP aggregate and MnDOT standard oil section 290110 and the SUPERPAVE section 270902 were placed July 26, along with the surface course of the SMA section 270903. The surface course consisting of MnDOT aggregate with SUPERPAVE modified oil section 270902 was also placed August 20, along with the base and level courses of MnDOT control section 270901.

Table 2. Bulk Material Sampling During Construction

Material and Sample Description	Number of Samples	Sample Location
Asphalt Concrete Coring - 4" Diam. Cores Bulk Sampling (100 lbs of each mix, uncompacted)	 21 3	 Regional Contractor Lab Minneapolis, MN
Asphalt Cement 5 gallons each sample	3	Regional Contractor Lab Minneapolis, MN
Materials Shipped to SHRP Asphalt Reference Library		
Asphalt Cement 5 gallon containers	9	SHRP Reference Library Reno, NV
Aggregate 55 gallon drums	3	SHRP Reference Library Reno, NV
Finished Asphaltic Concrete Mix 5 gallon containers	15	SHRP Reference Library Reno, NV

The contractor experienced several problems during construction, specifically with the existing concrete pavement deteriorating in areas after it was cracked and seated. In the area of test section 270910, the section with full-depth SHRP aggregate gradation and MnDOT standard oil, the concrete deteriorated from approximately station 3+57 and continuing to station 4+75. The distress began at a concrete joint. Due to the deterioration of the slab, the contractor requested that additional bituminous overlay material be placed in the areas of concern. An addition 1.5 inches of bituminous wearing course mixture was placed at a point beginning approximately 100 feet before the test section, to a point approximately 100 feet after the test section.

Because an increase in the surface layer for this section only would have been difficult to correlate to the other sections in the study, test section 270910 was moved approximately 200 feet to the south of the original location. Additional FWD testing was performed prior to placement of the bituminous overlay.

Construction of the SUPERPAVE and SMA mixtures went well, although the contractor did experience some difficulty in compacting the SUPERPAVE mixture. The material could not be compacted until cooled, and when it was rolled, a wave of material formed in front of the roller, resulting in transverse bumps throughout the section. The leveling course appeared to be soft and spongy after placement, but did not rut under traffic.

In addition, rain before paving caused mixture problems at the plant when producing the SMA mixture. The rain resulted in inconsistent moisture content values in the aggregate.

All work was completed on the test sections, and the roadway opened to traffic in October of 1993.

MINNESOTA DEPARTMENT OF TRANSPORTATION

REC'D 2-1-93

CONSTRUCTION PLAN FOR BITUMINOUS MILLING, CONCRETE PAVEMENT CRACKING, BITUMINOUS RESURFACING AND SLOPE FLATTENING

LOCATED ON T.H. 169 FROM T.H. 19 TO 45.85' NORTH OF BRIDGE NO. 6885 IN SHAKOPEE

STATE PROJ. NO. 7007-20	STATE PROJ. NO. 7008-37	STATE PROJ. NO. 7009-60
MINN. PROJ. NO. NH005-2(109)	MINN. PROJ. NO. NH005-2(109)	MINN. PROJ. NO. NH005-2(109)
GROSS LENGTH 36,960.00 FEET 7.000 MILES	GROSS LENGTH 45,133.44 FEET 8.548 MILES	GROSS LENGTH 49,811.52 FEET 9.434 MILES
BRIDGES-LENGTH 0.00 FEET 0.000 MILES	BRIDGES-LENGTH 0.00 FEET 0.000 MILES	BRIDGES-LENGTH 0.00 FEET 0.000 MILES
EXCEPTIONS-LENGTH 0.00 FEET 0.000 MILES	EXCEPTIONS-LENGTH 0.00 FEET 0.000 MILES	EXCEPTIONS-LENGTH 0.00 FEET 0.000 MILES
NET LENGTH 36,960.00 FEET 7.000 MILES	NET LENGTH 45,133.44 FEET 8.548 MILES	NET LENGTH 49,811.52 FEET 9.434 MILES
REF POINT 84+00.203 TO REF POINT 91+00.177	REF POINT 91+00.177 TO REF. POINT 99+00.725	REF. POINT 99+00.725 TO REF POINT 109+00.140

END S.P. 7009-60 (T.H. 169=5)
END MINN PROJ NH 005-2(109)

REF PT 109+00.140

REF POST	DIST. FROM PRECEDING POST IN MILES
84	
85	1.016
86	1.006
87	0.995
88	1.013
89	0.993
90	0.999
91	1.004
92	0.996
93	0.995
94	1.000
95	1.008
96	0.997
97	0.984
98	1.004
99	0.990
100	0.994
101	1.005
102	0.991
103	1.015
104	1.001
105	1.000
106	0.991
107	1.019
108	1.038
109	0.965
110	1.043

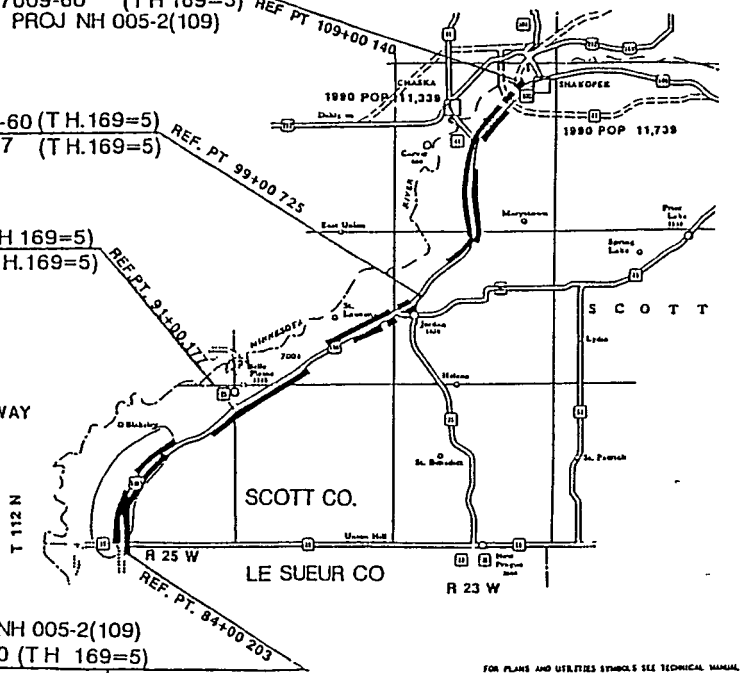
BEGIN S.P. 7009-60 (T.H. 169=5)
END S.P. 7008-37 (T.H. 169=5)

REF. PT 99+00.725

BEG S.P. 7008-37 (T.H. 169=5)
END S.P. 7007-20 (T.H. 169=5)

REF. PT. 91+00.177

MAINLINE ROADWAY CONSTRUCTION



BEG. MINN PROJ NH 005-2(109)
BEG S.P. 7007-20 (T.H. 169=5)

REF. PT. 84+00.203

SCALES

PLAN	500'
PROFILE	HORIZ. / VERT.
INDEX MAP	2 MI.
GENERAL LAYOUT	

PLAN REVISIONS

DATE	SHEET NO.	APPROVED BY
2/10/93	12,13	

DESIGN DESIGNATION - TIER NO. III

ADT (Current Year) 1991	= 21378	Posted Speed 55 MPH	
ADT (Future Year) 2010	= 25500	Based on ____ Sight Distance	
DHV (Design Hr Vol) 2010	= 3698	Height of eye ____ Height of object ____	
D (Directional Distrib)	= 60%	Design Speed not achieved als ____	
T (Heavy Commercial)	= 15 %	STA. ____ TO STA. ____ MPH	
		STA. ____ TO STA. ____ MPH	

PROJECT LOCATION
COUNTY : SCOTT
DISTRICT : METRO DIVISION GOLDEN VALLEY OFFICE

FOR PLANS AND UTILITIES SYMBOLS SEE TECHNICAL MANUAL

STATE PROJ. NO.	CHARGE IDENTIFIER
7007-20	
7008-37	
7009-60	

FED. PROJ. NO. NH005-2(109)

GOVERNING SPECIFICATIONS

THE 1988 EDITION OF THE MINNESOTA DEPARTMENT OF TRANSPORTATION "STANDARD SPECIFICATIONS FOR CONSTRUCTION" AS AMENDED BY THE JANUARY 2, 1991 SUPPLEMENTAL SPECIFICATION SHALL GOVERN.

INDEX

SHEET	DESCRIPTION
1	TITLE SHEET
2-3	STATEMENT OF ESTIMATED QUANTITIES
	STANDARD PLATES
	GRAVEL PITS
4	CONSTRUCTION AND SOILS NOTES
	TURF ESTABLISHMENT & EARTHWORK SUMMARY
5-17	TYPICAL SECTIONS
18	TYPICAL ENTRANCE PROFILE
19-20	ENTRANCE EARTHWORK AND CULVERTS
	ENTRANCE AND CROSS-OVER REMOVALS
	TRAFFIC BARRIER TABULATION
21	MANHOLE CONSTRUCTION DETAIL
22	CONCRETE MEDIAN DETAILS
23	MAILBOX SUPPORT DETAIL
24	RUMBLE STRIPS DETAIL
25-28	STANDARD PLANS
29-38	PLAN SHEETS

THIS PLAN CONTAINS 38 SHEETS

I HEREBY CERTIFY THAT THIS PLAN WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

DATE 1/11/93 REG. NO. 8926 Glen C. Ellis

DESIGN SQUAD GEORGE D. SHORBA TEL. 593-8509
2055 N. LILAC DRIVE
GOLDEN VALLEY, MN 55422-4099

RECOMMENDED FOR APPROVAL Timothy C. Gibson 1/11 1993
FOR METRO DIVISION

RECOMMENDED FOR APPROVAL ____ 19 ____

RECOMMENDED FOR APPROVAL ____ 19 ____

RECOMMENDED FOR APPROVAL ____ 19 ____

RECOMMENDED FOR APPROVAL Robert H. Lerstad 2-4 1993
FOR METRO DIVISION DESIGN ENGINEER

RIGHT OF WAY APPROVAL for [illegible] E. Rasmussen 2-5 1993
FOR DIRECTOR OF RIGHT OF WAY

APPROVED 2-5 1993 Roger M. Hill
STATE DESIGN ENGINEER

DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
APPROVED
[illegible] DATE

I HEREBY CERTIFY THAT THE FINAL FIELD REVISIONS, IF ANY OF THIS PLAN WERE MADE BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

DATE ____ REG. NO. ____

STATE PROJ NO. 7008-37 7009-60 (T.H. 169=5) 7007-20 (T.H. 169=5) SHEET NO. 1 OF 38 SHEETS

Figure 2. Project Location

Concrete Preparation

Prior to placement of the bituminous overlay, the concrete was cracked and seated using a guillotine type breaker. Cracking was spaced at 1.5 feet, and penetrated the entire width and depth of concrete. The intent of the cracking was to crack the concrete into 18 inch maximum size pieces.

After cracking, the pavement was seated. The equipment used was a pneumatic tired roller, with two wheels spaced 6-feet apart transversely. Gross weight on the roller was specified to be at least 15 tons per wheel. Seating was accomplished by making two passes with the heavy roller over each strip covered by the width of a tire. Unrolled areas between tire paths were specified to be less than 6 inches. Prior to cracking and seating the entire roadway, the contractor was required to demonstrate that the fracturing and seating operation was meeting the specifications on a 500 foot test strip.

After cracking and seating and prior to placement of the overlay, old bituminous patches and loose pieces of deteriorated concrete were removed from the joint and crack areas by air blasting. Depressions greater than 1.5 inches deep and 1.5 inches wide were filled with a bituminous patch mixture. Those depressions less than 1.5 inches deep were filled with bituminous leveling course prior to placement of the overlay.

Mix Designs and Paving

The mix designs for bituminous base and surface mixtures are given in Table 3. The MnDOT standard asphalt material (85/100) did not meet the SHRP specification for low temperature cracking, and was modified. A PG 58-35 asphalt cement was specified in the SUPERPAVE mix design.

Table 3. Construction Schedule

SPS: 9					Agency: Minnesota
Test Section		Construction		Range of Thicknesses	MST Completed
Layer	Designation	Start	Complete		
270902	SHRP Superpave				
1	Level Course	July 93	August 93	1.6 - 2.0 in.	Sept. 93
2	Base Course	July 93	August 93	1.1 - 2.0 in.	Sept. 93
3	Surface Course	July 93	August 93	2.4 - 2.6 in.	Sept. 93
270901	MnDOT Control				
1, 2, 3	All Layers	July 93	August 93	No data	Sept. 93
270903	SMA				
1	Surface Course	July 93	August 93	1.8 - 2.3 in.	Sept. 93
270910	SHRP Agg/MnDOT Oil				
1	Level Course	July 93	August 93	1.0 - 2.0 in.	Sept. 93
2	Base Course	July 93	August 93	2.3 - 2.5 in.	Sept. 93
3	Surface Course	July 93	August 93	1.6 - 1.9 in.	Sept. 93
270901	MnDOT Agg/SHRP Oil				
1, 2, 3	All Layers	July 93	August 93	No data	Sept. 93

Dates:
Opened to Traffic: October 1993
WIM Installed: Prior to Construction
WIM Operational: Prior to Construction
Weather Station Installed: Not to date

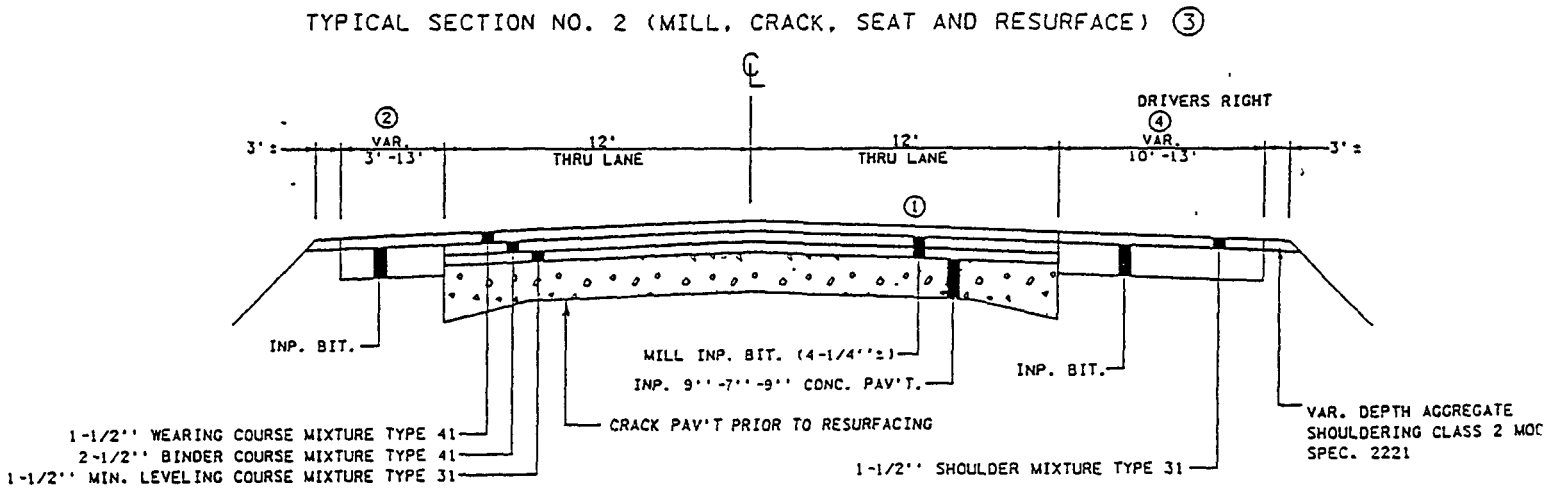
Significant Factors Which May Affect Performance of Section

Environmental
Rain prior to production of the SMA mixture caused some problems at the plant. Tests showed inconsistent moisture contents in the bituminous mixture aggregate.

Construction
During placement of the SUPERPAVE mixture, the contractor experienced some problems with compaction of the mix. The material appeared soft and spongy, and formed a wave in front of the roller, causing many transverse bumps throughout the section.

Table 4. Mix Designs

Properties	SUPERPAVE		MnDOT Standard		SMA
	NonWear	Wear	NonWear	Wear	Wear
Asphalt Content (%)	5.6 Level 5.4 Binder	5.4	5.8	6.1	6.0
Gradation					
Sieve Size					
1	100				
3/4	99.4	100	100		100
5/8			97		
1/2	89.9	95.2	89	100	92
3/8	82.7	84.9	80	99	70.2
No. 4	63.1	58.5	64	73	31.7
No. 8	30.5	31.8			16.6
No. 10			51	65	
No. 16	18.8	20.0			14.7
No. 20			42	47	
No. 30	13.8	14.6			13.4
No. 40			27	28	
No. 50	10.4	11.0			11.9
No. 80			9	10	
No. 100	5.9	6.1			
No. 200	3.6	3.6	5.2	3.9	8.2



① SEE NOTE ON SHEET 4.

② LEFT SHOULDER, LEFT TURN LANE OR CROSS OVER.

③

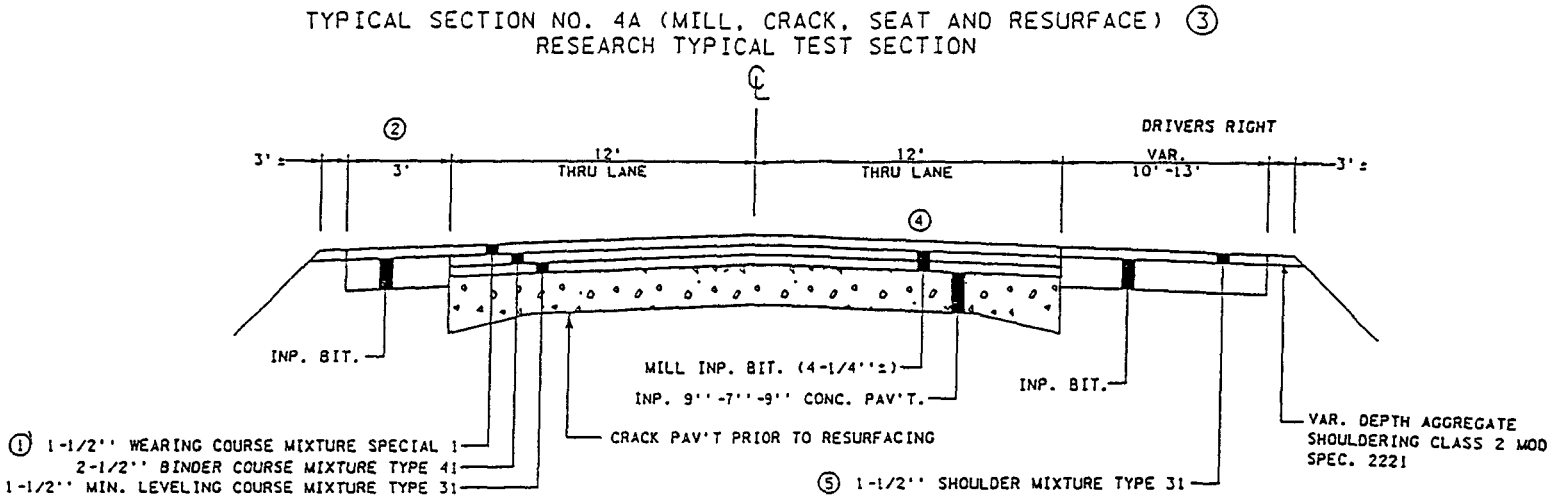
ROADWAY	REF. POINT	TO	REF. POINT
NORTHBOUND	87+00.787		88+00.799
NORTHBOUND	94+00.207		94+00.805
SOUTHBOUND	84+00.288		84+00.430
SOUTHBOUND	86+00.869		86+00.891
SOUTHBOUND	87+00.083		87+00.334
SOUTHBOUND	87+00.556		88+00.319
SOUTHBOUND	106+00.509		106+00.913

MILL THE INPLACE BITUMINOUS SURFACING FROM THE THRU DRIVING LANES. THE DEPTH OF MILLING SHOULD AVERAGE APPROXIMATELY 4-1/4 INCHES. DO NOT MILL THE SHOULDERS OR TURN LANES.

AFTER REMOVING THE BITUMINOUS SURFACING FROM THE THRU DRIVING LANES, CRACK, SEAT AND PATCH THE UNDERLYING CONCRETE PAVEMENT.

④ FOR RIGHT TURN LANE USE 1-1/2'' WEARING COURSE MIXTURE TYPE 41.

Figure 3. Typical Sections



MILL THE INPLACE BITUMINOUS SURFACING FROM THE THRU DRIVING LANES. THE DEPTH OF MILLING SHOULD AVERAGE APPROXIMATELY 4-1/4 INCHES. DO NOT MILL THE SHOULDERS OR TURN LANES.

AFTER REMOVING THE BITUMINOUS SURFACING FROM THE THRU DRIVING LANES, CRACK, SEAT AND PATCH THE UNDERLYING CONCRETE PAVEMENT.

① SPECIAL 1 CONSISTS OF 1-1/2'' THICK WEARING COURSE CONSTRUCTED USING MN/DOT GRADED AGGREGATE AND SHRP POLYMER MODIFIED ASPHALT CEMENT. THE BINDER AND LEVELING COURSES IN THIS SECTION SHALL BE CONSTRUCTED USING THE SAME MN/DOT MIXTURES AND ASPHALT CEMENTS AS USED IN THE NON-TEST PORTION OF THE PROJECT.

② LEFT SHOULDER.

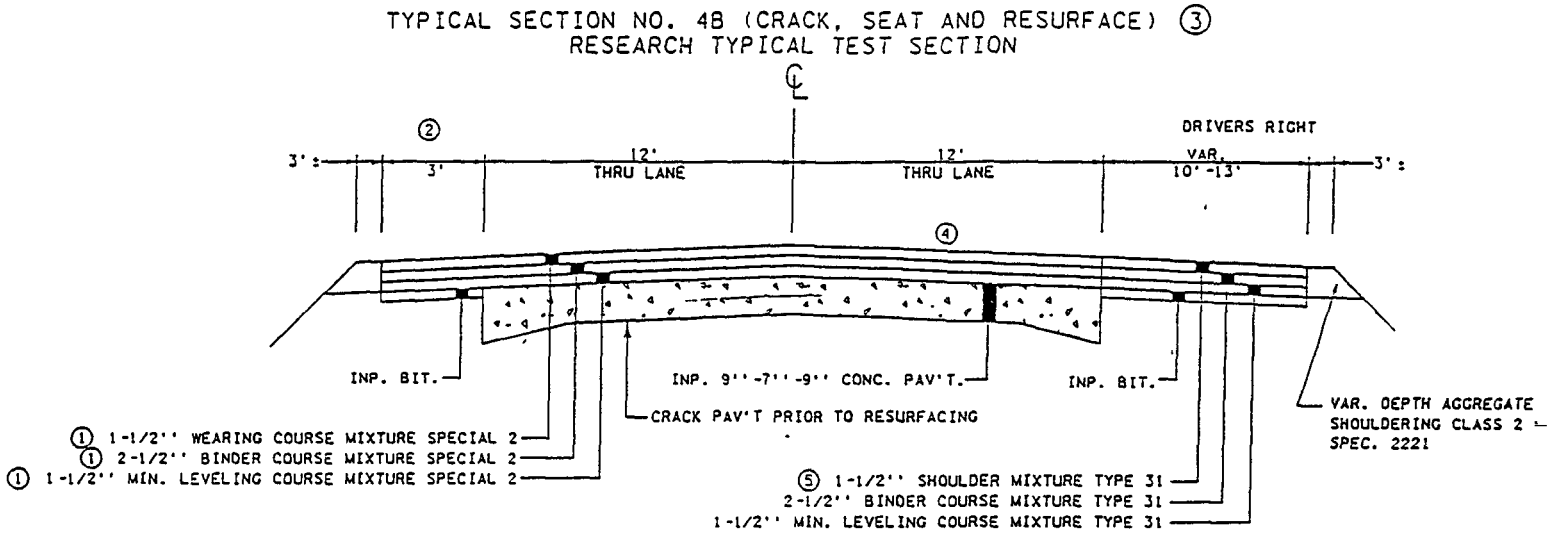
③

ROADWAY	REF. POINT	TO	REF. POINT
SOUTHBOUND	84+00.795		85+00.243

④ SEE NOTE ON SHEET 4.

⑤ FOR RIGHT TURN LANE USE 1-1/2'' WEARING COURSE MIXTURE TYPE 41.

Figure 3. Typical Sections (continued)



① SPECIAL 2 IS A 5-1/2'' THICK PAVEMENT CONSISTING OF WEARING, BINDER AND LEVELING COURSE CONSTRUCTED USING SHRP GRADED AGGREGATE AND THE SAME ASPHALT CEMENTS USED FOR CONSTRUCTION OF THE NON-TEST PORTION OF THE PROJECT.

② LEFT SHOULDER. FOR LEFT TURN LANE AND CROSS OVERS USE THE SAME THICKNESSES AND MIXTURES AS FOR RIGHT TURN LANE.

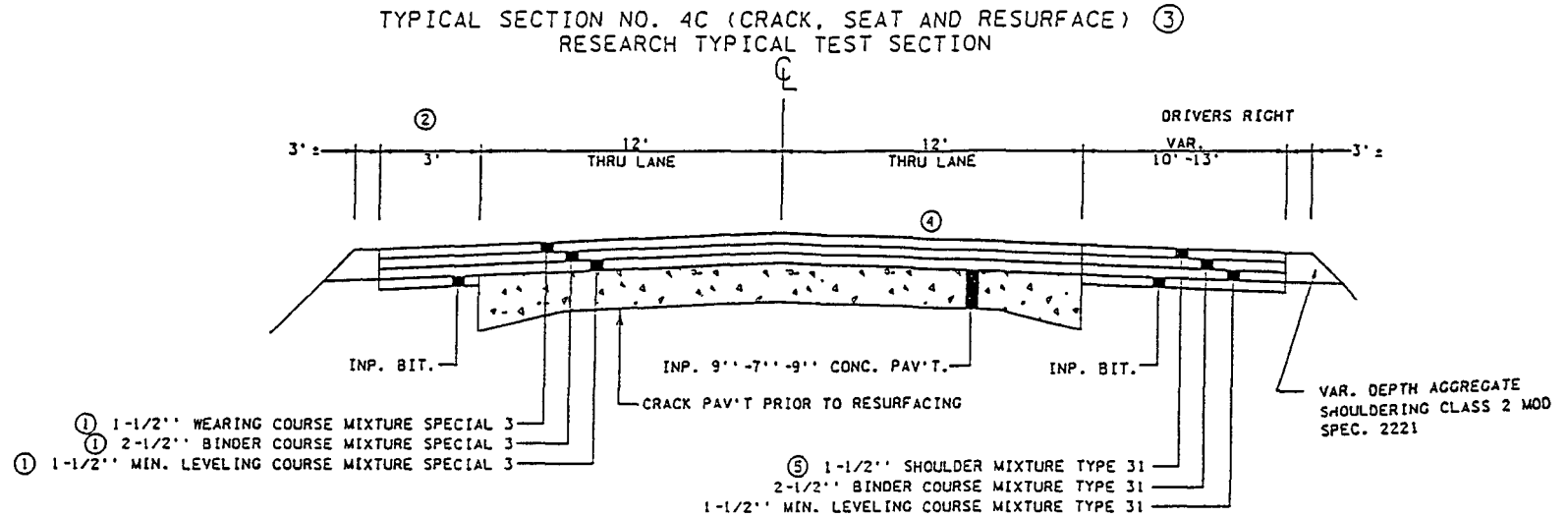
③

ROADWAY	REF. POINT	TO	REF. POINT
SOUTHBOUND	85+00.243		85+00.743

④ SEE NOTE ON SHEET 4.

⑤ FOR RIGHT TURN LANE USE 1-1/2'' WEARING COURSE MIXTURE TYPE 41.

Figure 3. Typical Sections (continued)



① SPECIAL 3 IS A 5-1/2'' THICK PAVEMENT CONSISTING OF WEARING, BINDER AND LEVELING COURSE CONSTRUCTED USING SHRP GRADED AGGREGATES AND SHRP POLYMER MODIFIED ASPHALT CEMENT.

② LEFT SHOULDER.

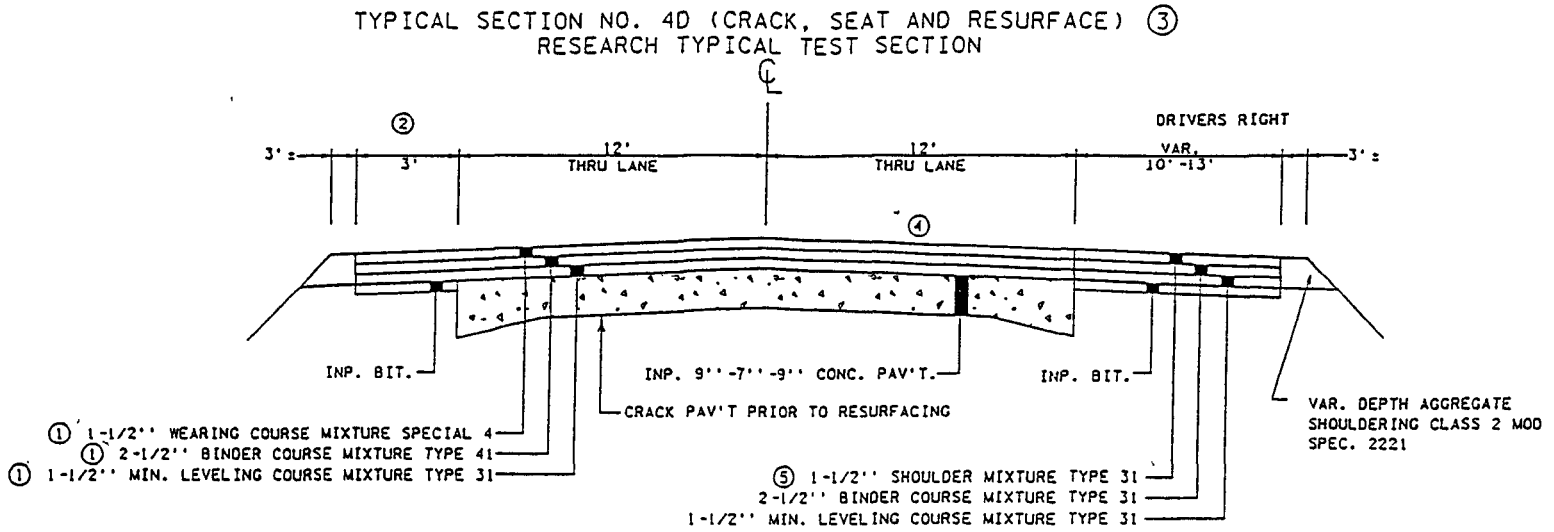
③

ROADWAY	REF. POINT	TO	REF. POINT
SOUTHBOUND	85+00.743		86+00.237

④ SEE NOTE ON SHEET 4

⑤ FOR RIGHT TURN LANE USE 1-1/2'' WEARING COURSE MIXTURE TYPE 41.

Figure 3. Typical Sections (continued)



① SPECIAL 4 CONSISTS OF 1-1/2'' THICK WEARING COURSE CONSTRUCTED USING GAP GRADED AGGREGATES AND SMA POLYMER MODIFIED ASPHALT CEMENT.

THE BINDER AND LEVELING COURSES IN THIS SECTION SHALL BE CONSTRUCTED USING THE SAME MN/DOT MIXTURES AND ASPHALT CEMENTS AS USED IN THE NON-TEST PORTION OF THE PROJECT.

② LEFT SHOULDER.

③

ROADWAY	REF. POINT	TO	REF. POINT
SOUTHBOUND	86+00.237		86+00.737

④ SEE NOTE ON SHEET 4.

⑤ FOR RIGHT TURN LANE USE 1-1/2'' WEARING COURSE MIXTURE TYPE 41.

Figure 3. Typical Sections (continued)

PRE-CONSTRUCTION SAMPLING AND TESTING

SPS-9
BELLE PLAINE, MN
US169 SOUTHBOUND

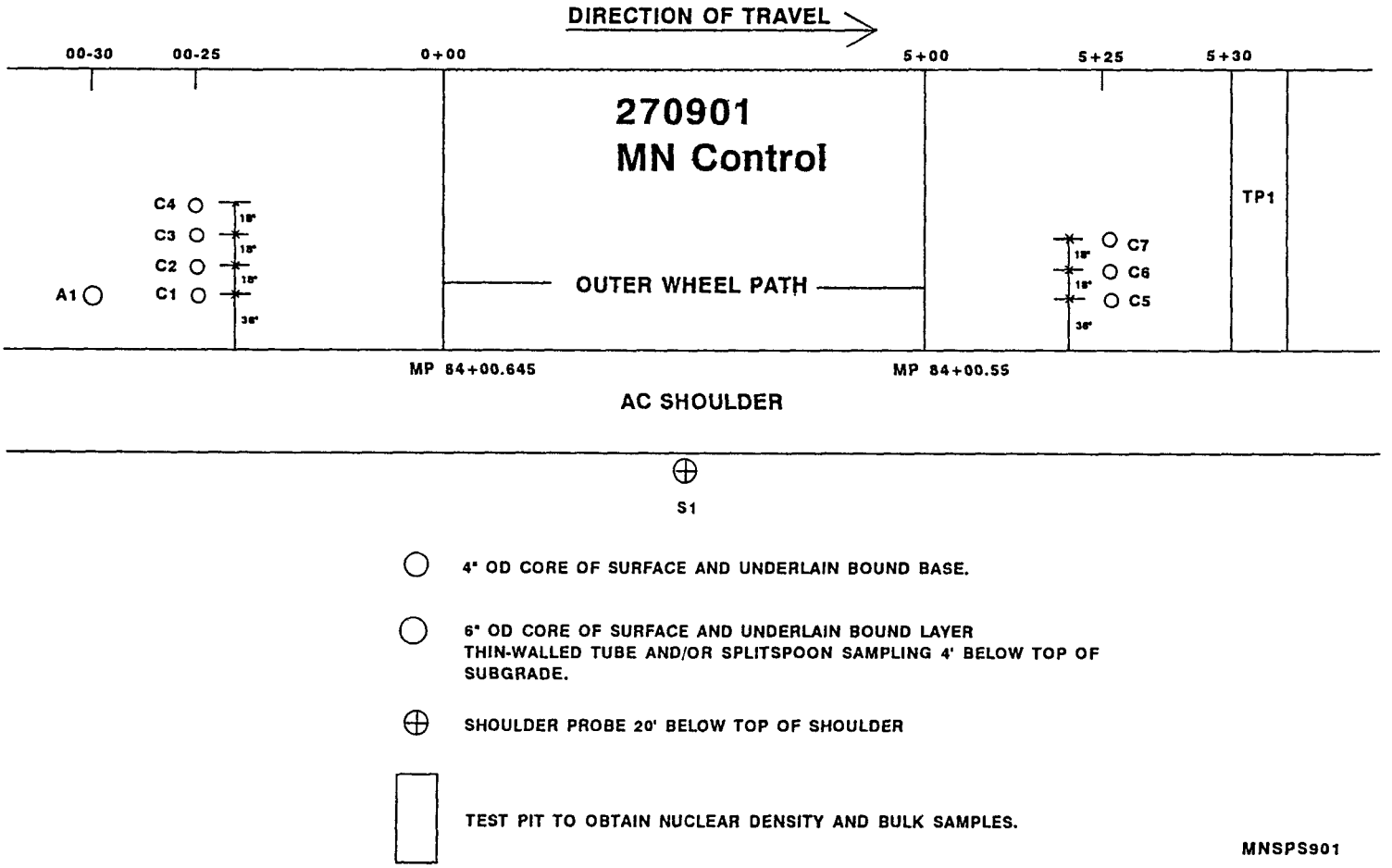


Figure 4. Material Sampling and Testing Plan

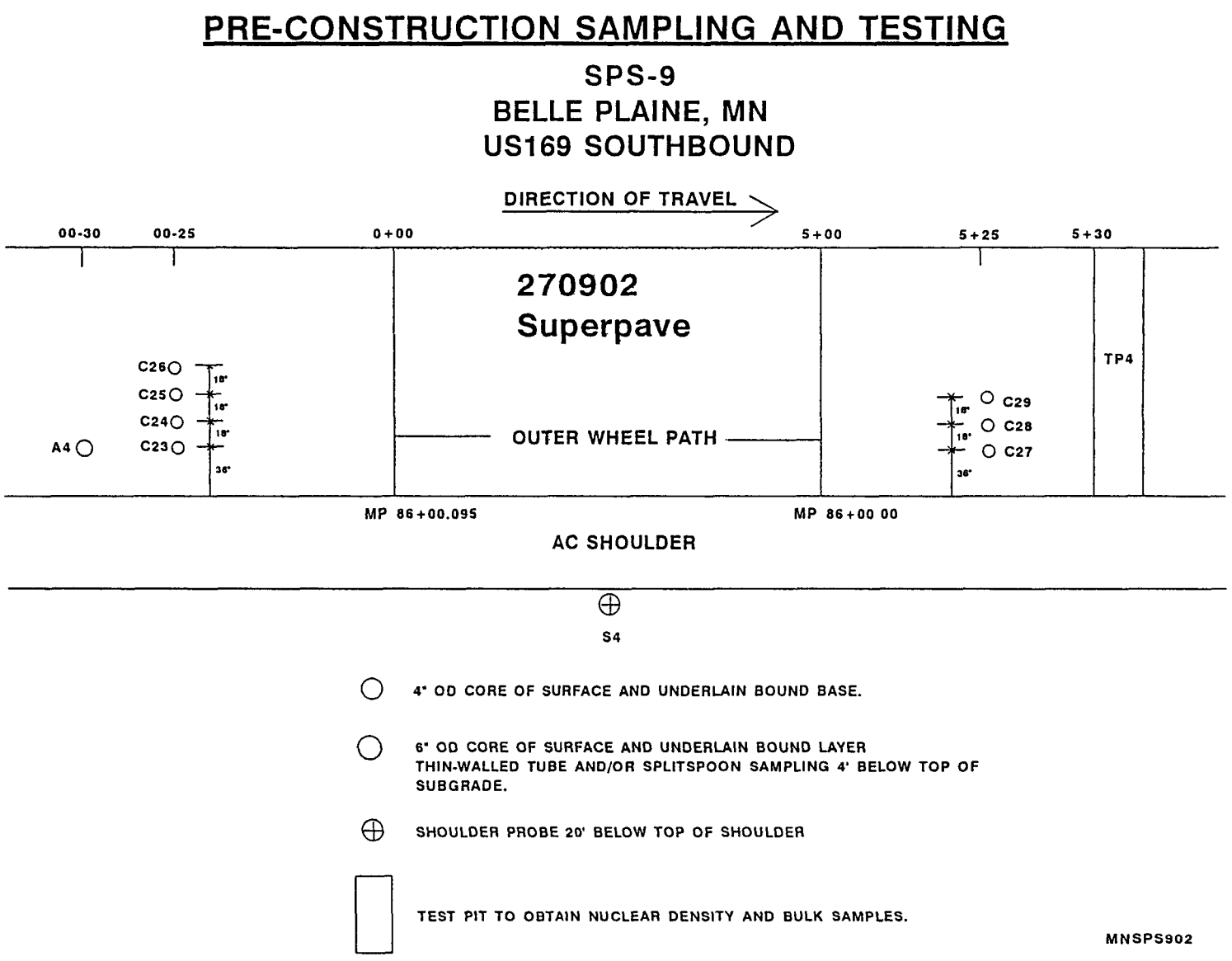


Figure 4. Material Sampling and Testing Plan (continued)

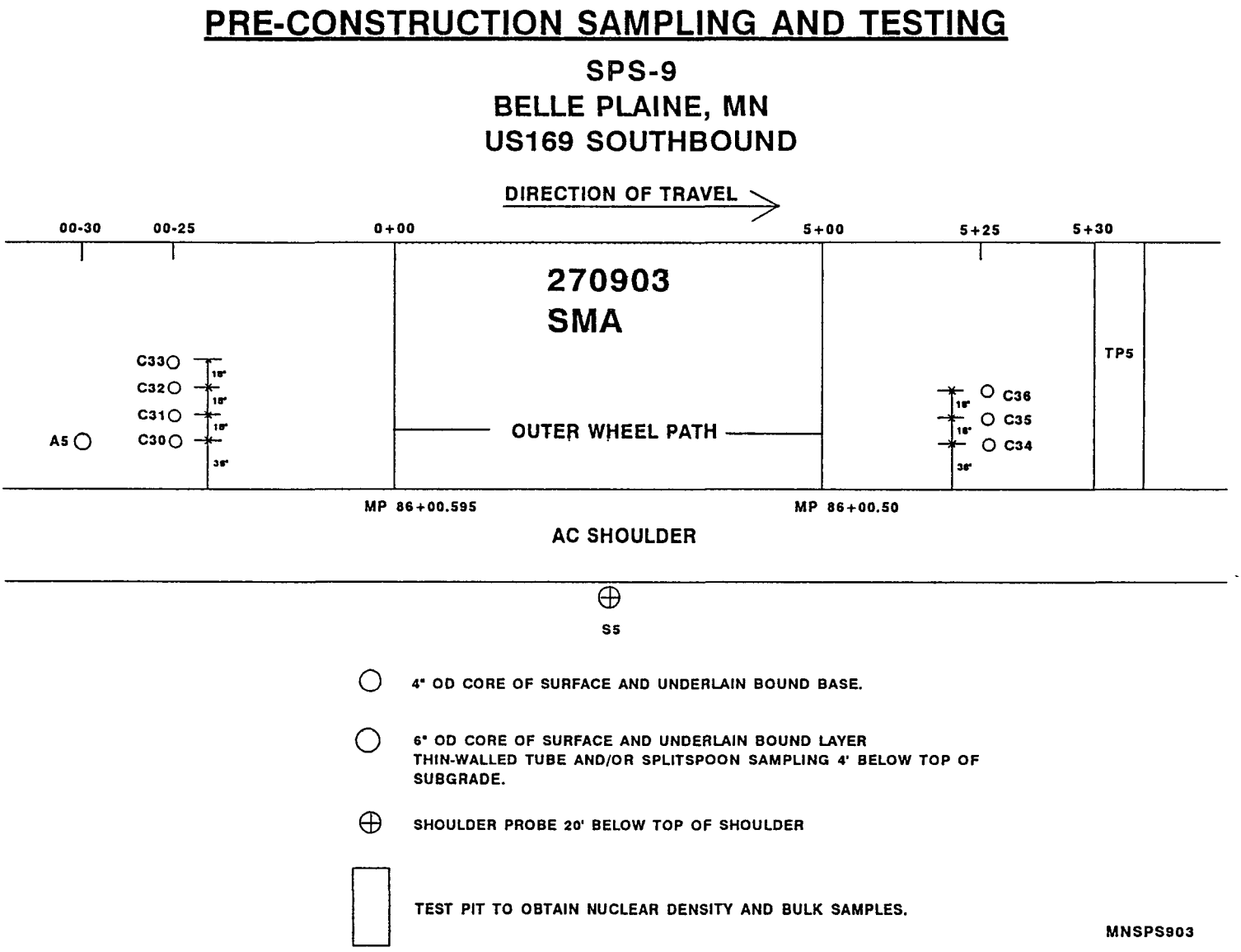


Figure 4. Material Sampling and Testing Plan (continued)

PRE-CONSTRUCTION SAMPLING AND TESTING

SPS-9
BELLE PLAINE, MN
US169 SOUTHBOUND

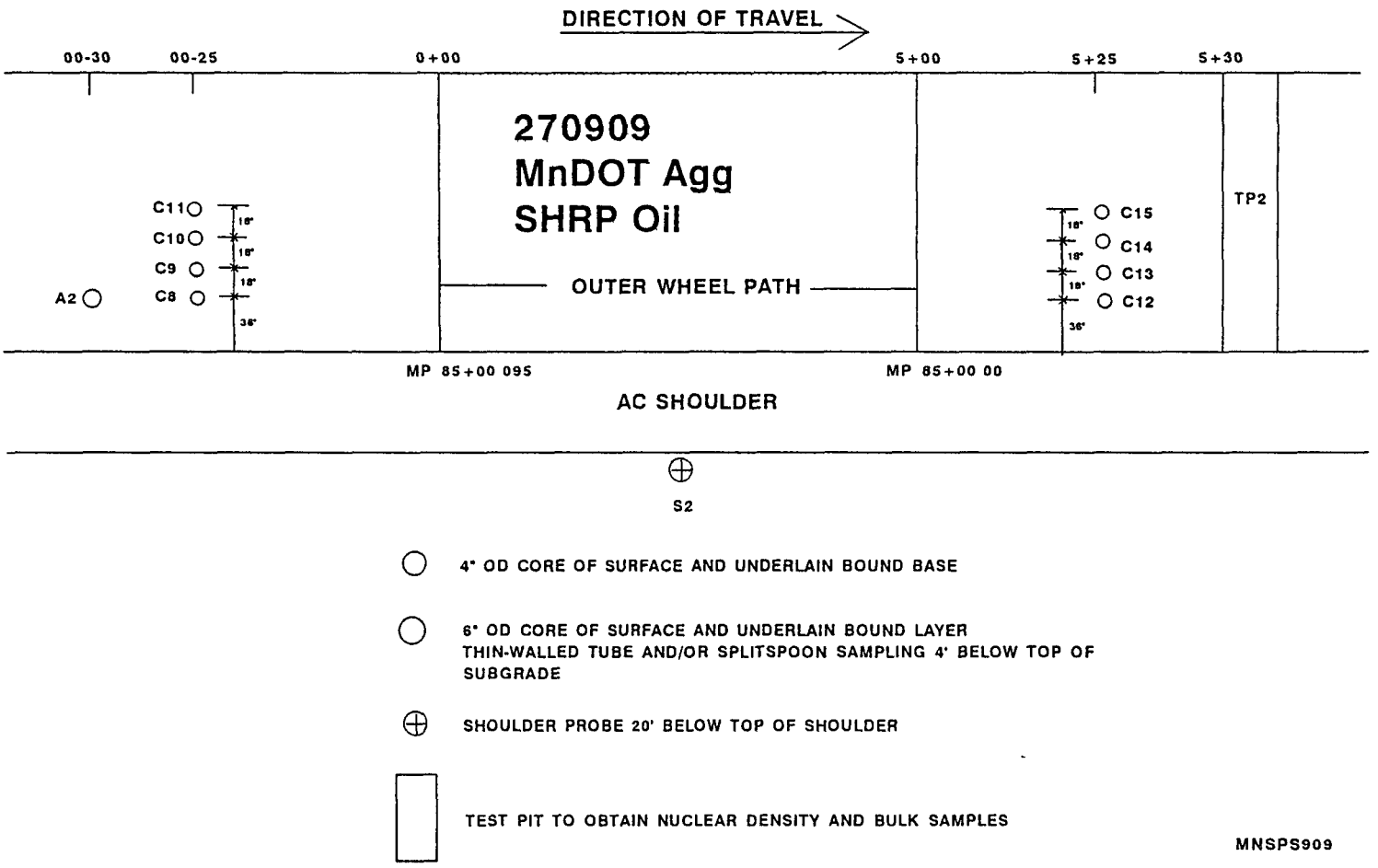


Figure 4. Material Sampling and Testing Plan (continued)

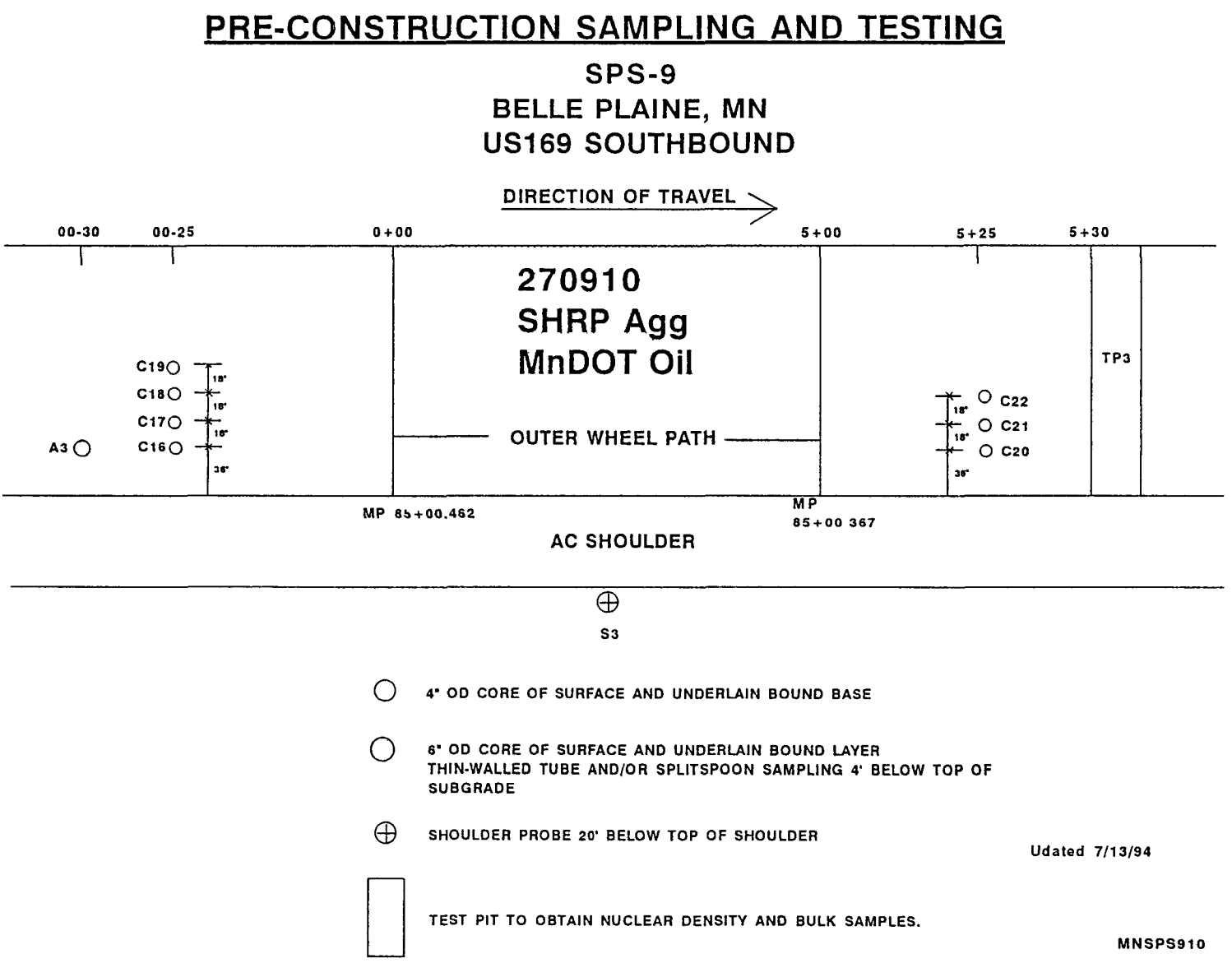
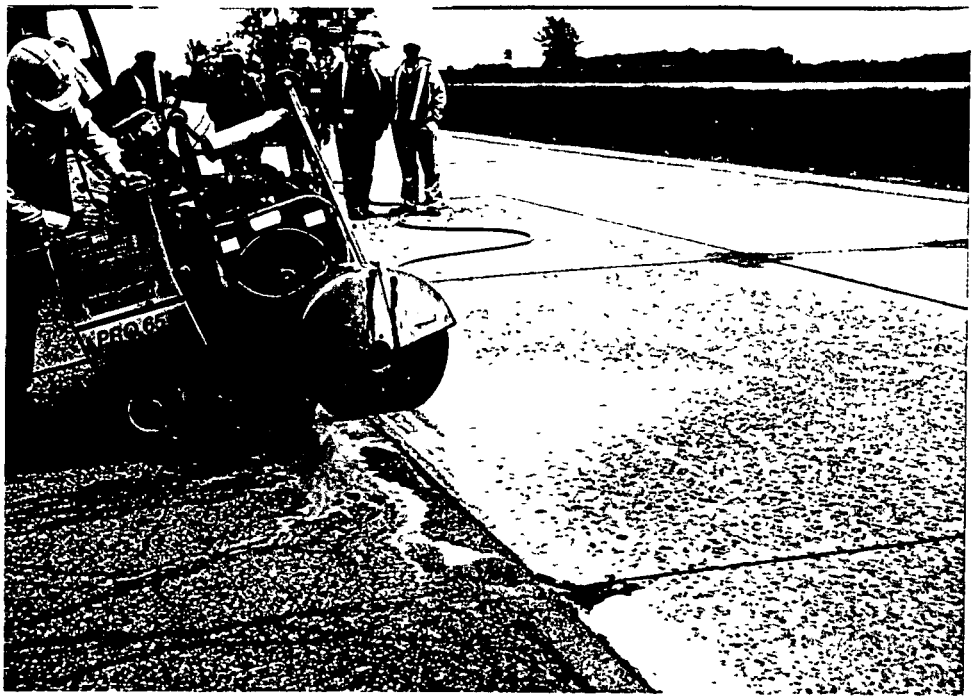


Figure 4. Material Sampling and Testing Plan (continued)

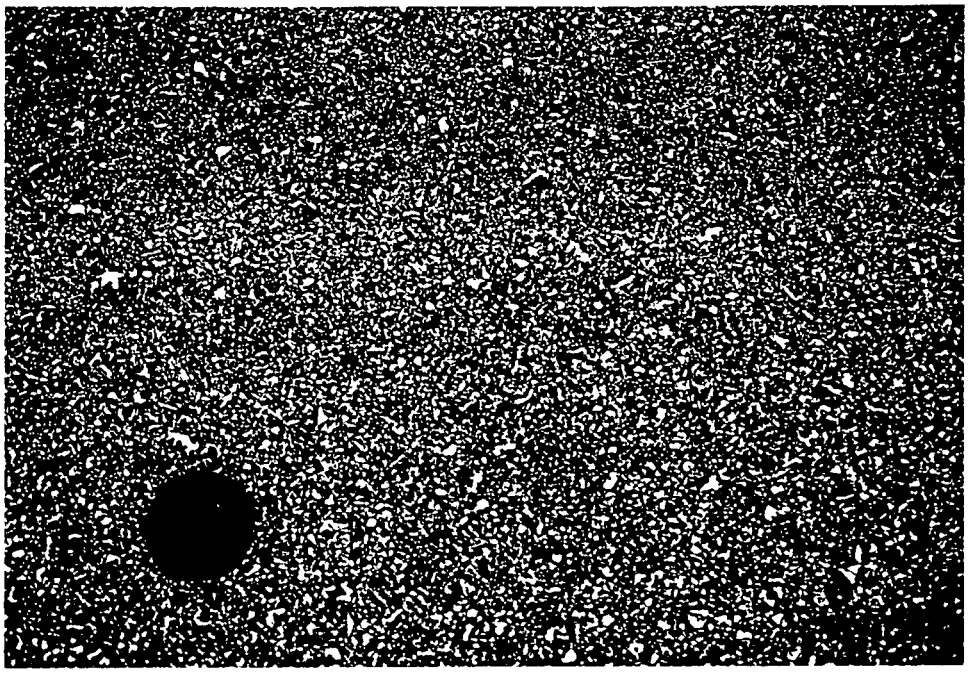
Photos



Test Pit for Minnesota SPS-9 Project
Showing Existing Cracked and Seated Concrete

SUPERPAVE Section 270902
Test Pit

MnDOT Section 270901

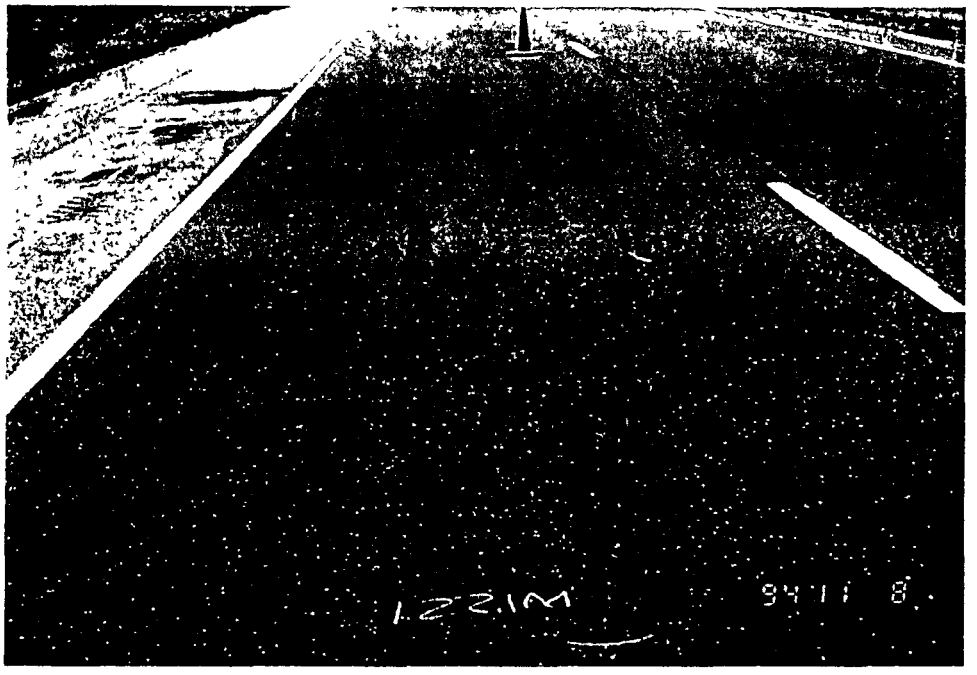


Superpave Section 270902

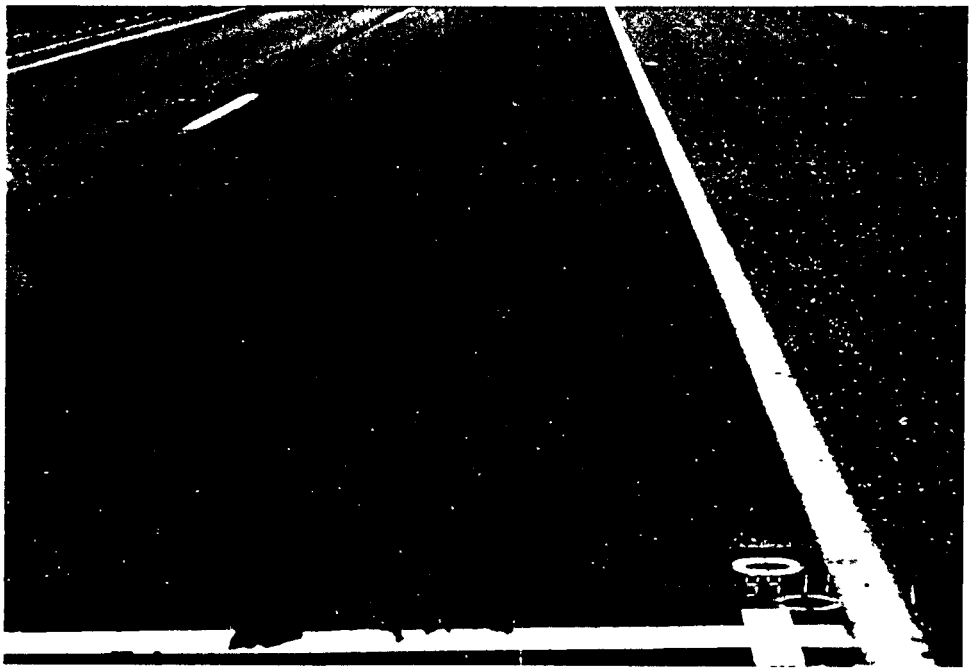
SMA Surface Course Section 270903

MnDOT Aggregate Gradation with Superpave Asphalt Cement Section 270909

Superpave Aggregate Gradation with MnDOT Asphalt Cement
Section 270910



MnDOT Control Section 270901



Superpave Section 270902